**PATENT**

**IN THE UNITED STATES PATENT AND TRADEMARK OFFICE**

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| In re the application of: **Ritter, et al.** | Conf. No.: | 9261 |
| Serial No.: 10/630,452 | Art Unit: | 2624 |
| Filed: July 30, 2003 | Examiner: | Chen, Wenpeng |
| For: SYSTEM AND METHOD FOR ROTATIONS OF TEXTURES DEFINED BY PARAMETRIC TEXTURE MAPS | Docket No.: | 100110416-1 |

# APPEAL BRIEF UNDER 37 C.F.R. §41.37

Mail Stop Appeal Brief - Patents
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

This Appeal Brief under 37 C.F.R. §41.37 is submitted in support of the Notice of Appeal filed June 20, 2007, responding to the final Office Action of March 20, 2007.

It is not believed that extensions of time or fees for net addition of claims are required, beyond those which may otherwise be provided for in documents accompanying this paper. However, in the event that additional extensions of time are necessary to allow consideration of this paper, such extensions are hereby petitioned under 37 C.F.R. §1.136(a), and any fees required therefor (including fees for net addition of claims) are hereby authorized to be charged to Hewlett-Packard Company Deposit Account No. 08-2025.

## I. REAL PARTY IN INTEREST

The real party in interest of the instant application is the assignee, Hewlett-Packard Development Company, L.P.

## II. RELATED APPEALS AND INTERFERENCES

There are no known related appeals and interference's that will affect or be affected by a decision in this appeal.

## III. STATUS OF THE CLAIMS

Claims 1-16 are pending in the present application. The final Office Action of March 20, 2007, rejected claims 1-16 under 35 U.S.C. §103 as allegedly unpatentable over *Watanabe* (U.S. Patent No. 6,384,834) in view of *Malzbender* ("Polynomial Texture Maps," Malzbender, Tom, et al., Proceedings of the 28$^{th}$ Annual Conference on Computer Graphics and Interactive Techniques, August 2001). Claims 1-16 are appealed.

## IV. STATUS OF AMENDMENTS

No amendments have been made or requested since the mailing of the final Office Action. A copy of the current claims is attached hereto as Appendix A.

## V. SUMMARY OF CLAIMED SUBJECT MATTER

A texture mapping system (*e.g.*, reference numeral 30) of some embodiments, such as that embodied by claim 1, comprises memory (*e.g.*, reference numeral 42) for storing a parametric texture map (*e.g.*, reference numeral 34) (*e.g.*, Paragraph 27, lines 1-4, and Figure 1). The parametric texture map has a plurality of texels defining a first texture, and at least one of the texels defines a variable expression that defines a luminosity parameter as a function of light direction (*e.g.*, Paragraph 27, lines 4-13, and Paragraph 47, lines 1-16). The texture mapping system further comprises a texture map manager (*e.g.*, reference numeral 32) configured to perform a rotation of the first texture thereby providing a parametric texture map defining a second texture that is rotated relative to the first texture (*e.g.*, Paragraph 96, lines 1-3). The texture map manager further configured to define a variable expression for a texel of the parametric texture map defining the second texture by adjusting the variable expression of the one texel to compensate for a change in relative light direction resulting from the rotation (*e.g.*, Paragraph 96, lines 1-3, and Paragraph 98, lines 1-11).

In at least one embodiment, such as that embodied by claim 4, the texture map manager is configured to adjust the variable expression of the one texel, in response to the rotation, such that the variable expression for the texel of the parametric texture map defining the second texture is defined according to the following equation:

$$F(u,v) = (AK^2 + BL^2 + CKL)u^2 + (AM^2 + BN^2 + CMN)v^2 + (2AKM + 2BLN + CKN + CML)uv + (DK + EL)u + (DM + EN)v + F,$$

wherein $K = \cos(x)$, $L = \sin(-x)$, $M = -\sin(x)$, $N = \cos(-x)$, and $x$ is indicative of an angle that the parametric texture map is rotated via the rotation (*e.g.*, see Paragraph 97).

A computer-readable medium of some embodiments, such as that embodied by claim 5, is encoded with a computer program. The program comprises logic for rotating a texture defined by a parametric texture map (*e.g.*, Paragraph 96, lines 1-3). The parametric texture map has a plurality of texels, and at least one of the texels defines a variable expression that

defines a luminosity parameter as a function of light direction (*e.g.*, Paragraph 27, lines 4-13, and Paragraph 47, lines 1-16). The program further comprises logic for compensating the variable expression of the one texel for a change in relative light direction resulting from a rotation of the texture by the rotating logic, and the compensating logic compensates for the change by adjusting the variable expression based on an angle of rotation for the texture to define a new variable expression defining the luminosity parameter for the rotated texture (*e.g.*, Paragraph 97, Paragraph 96, lines 1-3, and Paragraph 98, lines 1-11).

A texture mapping system of some embodiments, such as that embodied by claim 6, comprises means for rotating a texture defined by a parametric texture map (*e.g.*, Paragraph 96, lines 1-3). The parametric texture map has a plurality of texels, and at least one of the texels defines a variable expression that defines a luminosity parameter as a function of light direction (*e.g.*, Paragraph 27, lines 4-13, and Paragraph 47, lines 1-16). The texture mapping system further comprises means for compensating the variable expression of the one texel for a change in relative light direction resulting from a rotation of the texture by the rotating means, and the compensating means compensates for the change by adjusting the variable expression based on an angle of rotation for the texture to define a new variable expression defining the luminosity parameter for the rotated texture (*e.g.*, Paragraph 97, Paragraph 96, lines 1-3, and Paragraph 98, lines 1-11).

A texture mapping method of some embodiments, such as that embodied by claim 7, comprises rotating a texture defined by a parametric texture map (*e.g.*, Paragraph 96, lines 1-3). The parametric texture map has a plurality of texels, and at least one of the texels defines a variable expression that defines a luminosity parameter as a function of light direction (*e.g.*, Paragraph 27, lines 4-13, and Paragraph 47, lines 1-16). The method further comprises compensating for a change in relative light direction resulting from the rotating, and the compensating comprises adjusting the variable expression of the one texel thereby defining a new variable expression that defines the luminosity parameter for the rotated texture (*e.g.*, Paragraph 97, Paragraph 96, lines 1-3, and Paragraph 98, lines 1-11).

In at least one embodiment, such as that embodied by claim 10, the new variable expression is defined according to the following equation:

$$F(u,v) = (AK^2 + BL^2 + CKL)u^2 + (AM^2 + BN^2 + CMN)v^2 + (2AKM + 2BLN + CKN + CML)uv + (DK + EL)u + (DM + EN)v + F,$$

wherein K = cos(x), L = sin(-x), M = -sin(x), N = cos(-x), and x is indicative of an angle that the texture is rotated via the rotating (*e.g.*, see Paragraph 97).

A texture mapping method of some embodiments, such as that embodied by claim 11, comprises rotating a texture defined by a parametric texture map (*e.g.*, Paragraph 96, lines 1-3). The parametric texture map has a plurality of texels, and at least one of the texels defines a variable expression that defines a luminosity parameter as a function of light direction (*e.g.*, Paragraph 27, lines 4-13, and Paragraph 47, lines 1-16). The method further comprises compensating the variable expression of the one texel for a change in relative light direction resulting from the rotating, and the compensating comprises adjusting the variable expression of the one texel based on an angle of rotation of the texture thereby defining a variable expression for a texel that defines a portion of the rotated texture (*e.g.*, Paragraph 97, Paragraph 96, lines 1-3, and Paragraph 98, lines 1-11).

In at least one embodiment, such as that embodied by claim 14, the variable expression for the texel defining the portion of the second texture is defined according to the following equation:

$$F(u,v) = (AK^2 + BL^2 + CKL)u^2 + (AM^2 + BN^2 + CMN)v^2 + (2AKM + 2BLN + CKN + CML)uv + (DK + EL)u + (DM + EN)v + F,$$

wherein K = cos(x), L = sin(-x), M = -sin(x), N = cos(-x), and x is indicative of an angle that the texture is rotated via the rotating (*e.g.*, see Paragraph 97).

## VI. GROUNDS OF REJECTION TO BE REVIEWED ON APPEAL

Claims 1-16 are rejected under 35 U.S.C. §103 as allegedly unpatentable over *Watanabe* (U.S. Patent No. 6,384,834) in view of *Malzbender* ("Polynomial Texture Maps," Malzbender, Tom, et al., Proceedings of the 28th Annual Conference on Computer Graphics and Interactive Techniques, August 2001).

## VII. ARGUMENT

**35 U.S.C. §103 Rejections**

In order for a claim to be properly rejected under 35 U.S.C. §103, the combined teachings of the prior art references must suggest all features of the claimed invention to one of ordinary skill in the art. See, *e.g.*, *In Re Dow Chemical Co.*, 837 F.2d 469, 5 U.S.P.Q.2d 1529, 1531 (Fed. Cir. 1988), and *In re Keller*, 642 F.2d 413, 208 U.S.P.Q. 871, 881 (C.C.P.A. 1981). In addition, "(t)he PTO has the burden under section 103 to establish a *prima facie* case of obviousness." *In re Fine*, 837 F.2d 1071, 5 U.S.P.Q.2d 1596, 1598 (Fed. Cir. 1988).

**Discussion of 35 U.S.C. §103 Rejections of Claims 1-3, 5-9, 11-13, 15, and 16**

Claim 1 presently stands rejected in the final Office Action under 35 U.S.C. §103 as allegedly unpatentable over *Watanabe* (U.S. Patent No. 6,384,834) in view of *Malzbender* ("Polynomial Texture Maps," Malzbender, Tom, et al., Proceedings of the 28th Annual Conference on Computer Graphics and Interactive Techniques, August 2001). Claims 5-7 and 11 comprise similar claimed limitations which are missing from the alleged combination (with respect to the outstanding 35 U.S.C. §103 rejections) as claim 1. Claims 2, 3, 8, 9, 12, 13, 15, and 16 depend from a respective one of the claims 1, 7, and 11. Therefore, claim 1 is discussed below as an exemplary claim for discussion.

Claim 1 presently reads as follows:

> 1. A texture mapping system, comprising:
> memory for storing a parametric texture map, the parametric texture map having a plurality of texels defining a first texture, at least one of the texels defining a variable expression that defines a luminosity parameter as a function of light direction; and
> ***a texture map manager configured to perform a rotation of the first texture thereby providing a parametric texture map defining a second texture that is rotated relative to the first texture, the texture map manager further configured to define a variable expression for a texel of the parametric texture map defining the second texture by adjusting the variable expression of the one texel to compensate for a change in relative light direction resulting from the rotation***. (Emphasis added).

Applicants respectfully assert that the alleged combination of *Watanabe* and *Malzbender* fails to suggest at least the features of claim 1 highlighted hereinabove. Accordingly, the 35 U.S.C. §103 rejection of claim 1 is improper.

In this regard, it is candidly admitted in the final Office Action that *Watanabe* fails to suggest a texture map that has "texels defining a variable expression that defines a luminosity parameter as a function of light direction." It is then alleged in the Office Action that such features are suggested by *Malzbender*. Applicants agree that *Malzbender* describes texture maps having a texel "defining a variable expression that defines a luminosity parameter as a function of light direction," but Applicants submit that *Malzbender* fails to suggest defining "a variable expression for a texel" by "adjusting" a texel's variable expression "to compensate for a change in relative light direction resulting from the rotation," as described by claim 1.

In particular, *Malzbender* appears to describe a "texture map" that has texels defining variable expressions. When mapped to a graphical object, constants (*e.g.*, u and v) representing the light direction from a simulated light source for the graphical image being displayed are used to evaluate the variable expressions defined by the texels. Thus, if the graphical object is rotated relative to the simulated light source, different constants (*e.g.*, u and v) would be used to evaluate the variable expressions resulting in different luminosity values for the pixel that is mapped to the texel. That is, prior to rotation of the graphical object, a first set of constants ($u_1$ and $v_1$) would be substituted for variables in the "variable expression" of a

texel, and after such rotation, a second set of constants ($u_2$ and $v_2$) would be substituted for variables in the "variable expression" of the texel. Thus, for the same texel, a first luminosity value would be calculated prior to rotation, and a second luminosity value would be calculated after rotation. In both cases, the resulting expression is not "variable." Moreover, *Malzbender* fails to suggest that the "variable expression" of a texel should be "adjusted" to define a new "variable expression" in order to compensate for a texture rotation.

The aforedescribed differences should be viewed in light of the different purposes of the variable expression evaluations described by *Malzbender* and the variable expression adjustments recited by claim 1. In this regard, by evaluating a variable expression of a texel differently based on different constant values (*e.g.*, u and v), *Malzbender* accounts for changes in light direction relative to a ***simulated*** light source, which is illuminating the ***graphical object***. However, by "adjusting" a variable expression of a texel to define a new "variable expression" for a "parametric texture map" defining a rotated texture, as recited by claim 1, it is possible to prevent or reduce distortions resulting from changes in light direction relative to a light source ***used to define the variable expressions***.

For example, in one exemplary embodiment of the instant application, a "parametric texture map" is created by using ***actual*** light sources to illuminate an actual ***texture sample*** from many different directions. Images of the texture sample are captured for different light directions, and these images are analyzed to define the "variable expressions" of a "parametric texture map." See Paragraphs 37-42. By adjusting a "variable expression" of a texel, as described by the instant disclosure, the claimed system compensates for a change in light direction relative to the ***actual*** light sources used to create a "parametric texture map," unlike the cited art which apparently uses constants to evaluate variable expressions in order to account for changes in light directions relative to ***simulated*** light sources illuminating a ***graphical object***. Moreover, *Malzbender* provides no reason or motivation whatsoever to adjust the "variable expression" of a texel in order to define a "variable expression" of a

"parametric texture map" thereby compensating for "a change in relative light direction" resulting from a rotation of a texture.

In addition, Applicants submit that *Watanabe* fails to remedy the deficiencies of *Malzbender*. First of all, *Watanabe* fails to suggest texels having variable expressions of any kind and, therefore, fails to suggest any adjustment of a texel's "variable expression." Further, it is alleged in the final Office Action that *Watanabe* describes the rotation of a "texture map" at column 12, lines 23-67. Such section of *Watanabe* appears to describe the mapping of a texture map to a graphical object. During such mapping, *Watanabe* describes an "inversion perspective projection conversion." Even if such "conversion" could be arguably construed as a "rotation" of a "texture map," Applicants submit that *Watanabe* fails to suggest that the "texture information" read from the storage section 242 is adjusted in any way to account for such "rotation." Indeed, for the "inversion perspective projection conversion," *Watanabe* describes a conversion of texel ***coordinates***, but not of the texel data read from the storage section 242. Thus, even if it would be obvious to include the variable expressions of *Malzbender* in the "texture information" stored in the storage section 242 of *Watanabe*, as apparently alleged in the final Office Action, there is nothing in *Watanabe* to suggest that such variable expressions should be adjusted in any way to account for the "inversion perspective projection conversion." Further, as described above, *Malzbender* fails to suggest that any texel's "variable expression" should be adjusted to define a new "variable expression" of a "parametric texture map" thereby compensating for a texture rotation, as described by claim 1.

Moreover, *Watanabe* and *Malzbender*, when taken alone or in combination, fail to suggest compensating for a relative change in light direction resulting from a rotation of a second texture relative to a first texture by adjusting a "variable expression" of at least one texel in order to "define a ***variable expression*** for a texel of the parametric texture map defining the second texture." (Emphasis added). Thus, the alleged combination fails to suggest at least "a texture map manager configured to perform a rotation of the first texture thereby providing a parametric texture map defining a second texture that is rotated relative to

the first texture, the texture map manager further configured to ***define a variable expression for a texel of the parametric texture map defining the second texture by adjusting the variable expression of the one texel to compensate for a change in relative light direction resulting from the rotation***," as recited by claim 1. (Emphasis added).

For at least the above reasons, Applicants respectfully assert that the alleged combination of *Watanabe* and *Malzbender* fails to suggest each feature of claim 1. Accordingly, the 35 U.S.C. §103 rejection of claim 1 should be overruled.

**Discussion of 35 U.S.C. §103 Rejection of Claims 4, 10, and 14**

Claim 4 presently stands rejected in the final Office Action under 35 U.S.C. §103 as allegedly unpatentable over *Watanabe* in view of *Malzbender*. Claims 10 and 14 comprise similar claimed limitations which are missing from the alleged combination (with respect to the outstanding 35 U.S.C. §103 rejections) as claim 4. Therefore, claim 4 is discussed below as an exemplary claim for discussion.

In rejecting claim 4, it is asserted in the final Office Action that:

> "With regard to Claims 4, 10, and 14, the recited expression is an obvious result of transformation from a vector to another due to rotation. When an object, such as the running surface of a tire, is rotated, the light vector with respect to the texture surface coordinates changes accordingly. The transformation represented in paragraphs [0101]-[0109] of the present application is just the change of parameters because the change of the direction of a light vector. So when one applies Watanabe's teaching to rotate Malzbender's polynomial texture map, one inherently will reach the same expression recited in Claims 4, 10, and 14. Therefore, combination of Watanabe and Malzbender as discussed above also teaches Claims 4, 10, and 14."

The rotation of a graphical object, such as a "tire," with respect to a simulated light source illuminating the graphical object may result in a different light vector (*e.g.*, different values of u and v) for a particular pixel of a graphical object. However, as described above in the Discussion of 35 U.S.C. §103 Rejections of Claims 1-3, 5-9, 11-13, 15, and 16, according to the teachings of the cited art, such a rotation would presumably be accommodated by evaluating the variable expressions of a "parametric texture map" for different light values, u

and v, as the graphical object is being rotated and the light direction from the simulated light source is changing. There is nothing in the cited art to suggest that the rotation of a graphical object should result in adjustment of a "variable expression" for a texel to define a "variable expression" of a "parametric texture map" defining a rotated texture. Accordingly, the cited art fails to suggest at least the equation recited by claim 4.

For at least the above reasons, Applicants respectfully assert that the cited art fails to suggest each feature of claim 4. Accordingly, the 35 U.S.C. §103 rejection of claim 4 should be overruled.

## CONCLUSION

Based on the foregoing discussion, Applicant respectfully requests that the Examiner's final rejections of claims 1-16 be overruled and withdrawn by the Board, and that the application be allowed to issue as a patent with all pending claims.

Respectfully submitted,

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## VIII. CLAIMS - APPENDIX

1. A texture mapping system, comprising:

memory for storing a parametric texture map, the parametric texture map having a plurality of texels defining a first texture, at least one of the texels defining a variable expression that defines a luminosity parameter as a function of light direction; and

a texture map manager configured to perform a rotation of the first texture thereby providing a parametric texture map defining a second texture that is rotated relative to the first texture, the texture map manager further configured to define a variable expression for a texel of the parametric texture map defining the second texture by adjusting the variable expression of the one texel to compensate for a change in relative light direction resulting from the rotation.

2. The system of claim 1, wherein the variable expression of the one texel defines a luminosity behavior for the one texel.

3. The system of claim 1, wherein the variable expression of the one texel is defined according to the following equation:

$$F(u,v) = Au^2 + Bv^2 + Cuv + Du + Ev + F,$$

wherein A, B, C, D, E, and F are constants, and wherein u and v are components of a light vector.

4. The system of claim 3, wherein the texture map manager is configured to adjust the variable expression of the one texel, in response to the rotation, such that the variable expression for the texel of the parametric texture map defining the second texture is defined according to the following equation:

$$F(u,v) = (AK^2 + BL^2 + CKL)u^2 + (AM^2 + BN^2 + CMN)v^2 + (2AKM + 2BLN + CKN + CML)uv + (DK + EL)u + (DM + EN)v + F,$$

wherein K = cos(x), L = sin(-x), M = -sin(x), N = cos(-x), and x is indicative of an angle that the parametric texture map is rotated via the rotation.

5. A computer-readable medium encoded with a computer program, the program comprising:

logic for rotating a texture defined by a parametric texture map, the parametric texture map having a plurality of texels, at least one of the texels defining a variable expression that defines a luminosity parameter as a function of light direction; and

logic for compensating the variable expression of the one texel for a change in relative light direction resulting from a rotation of the texture by the rotating logic, wherein the compensating logic compensates for the change by adjusting the variable expression based on an angle of rotation for the texture to define a new variable expression defining the luminosity parameter for the rotated texture.

6. A texture mapping system, comprising:

means for rotating a texture defined by a parametric texture map, the parametric texture map having a plurality of texels, at least one of the texels defining a variable expression that defines a luminosity parameter as a function of light direction; and

means for compensating the variable expression of the one texel for a change in relative light direction resulting from a rotation of the texture by the rotating means, wherein the

compensating means compensates for the change by adjusting the variable expression based on an angle of rotation for the texture to define a new variable expression defining the luminosity parameter for the rotated texture.

7. A texture mapping method, comprising:

rotating a texture defined by a parametric texture map, the parametric texture map having a plurality of texels, at least one of the texels defining a variable expression that defines a luminosity parameter as a function of light direction; and

compensating for a change in relative light direction resulting from the rotating, the compensating comprising adjusting the variable expression of the one texel thereby defining a new variable expression that defines the luminosity parameter for the rotated texture.

8. The method of claim 7, further comprising indicating, via the variable expression of the one texel, a luminosity behavior for the one texel.

9. The method of claim 7, wherein the variable expression of the one texel is defined according to the following equation:

$$F(u,v) = Au^2 + Bv^2 + Cuv + Du + Ev + F,$$

wherein A, B, C, D, E, and F are constants, and wherein u and v are components of a light vector.

10. The method of claim 9, wherein the new variable expression is defined according to the following equation:

$$F(u,v) = (AK^2 + BL^2 + CKL)u^2 + (AM^2 + BN^2 + CMN)v^2 + (2AKM + 2BLN + CKN + CML)uv + (DK + EL)u + (DM + EN)v + F,$$

wherein K = cos(x), L = sin(-x), M = -sin(x), N = cos(-x), and x is indicative of an angle that the texture is rotated via the rotating.

11. A texture mapping method, comprising:

rotating a texture defined by a parametric texture map, the parametric texture map having a plurality of texels, at least one of the texels defining a variable expression that defines a luminosity parameter as a function of light direction; and

compensating the variable expression of the one texel for a change in relative light direction resulting from the rotating, wherein the compensating comprises adjusting the variable expression of the one texel based on an angle of rotation of the texture thereby defining a variable expression for a texel that defines a portion of the rotated texture.

12. The method of claim 11, further comprising indicating, via the variable expression of the one texel, a luminosity behavior for the one texel.

13. The method of claim 11, wherein the variable expression of the one texel is defined according to the following equation:

$$F(u,v) = Au^2 + Bv^2 + Cuv + Du + Ev + F,$$

wherein A, B, C, D, E, and F are constants, and wherein u and v are components of a light vector.

14. The method of claim 13, wherein the variable expression for the texel defining the portion of the second texture is defined according to the following equation:

$$F(u,v) = (AK^2 + BL^2 + CKL)u^2 + (AM^2 + BN^2 + CMN)v^2 + (2AKM + 2BLN + CKN + CML)uv + (DK + EL)u + (DM + EN)v + F,$$

wherein K = cos(x), L = sin(-x), M = -sin(x), N = cos(-x), and x is indicative of an angle that the texture is rotated via the rotating.

15. The system of claim 11, further comprising:

applying the rotated texture to a graphical object based on the variable expression for the texel defining the portion of the second texture; and

displaying the graphical object.

16. The system of claim 7, further comprising:

applying the rotated texture to a graphical object based on the new variable expression; and

displaying the graphical object.

## IX. EVIDENCE - APPENDIX

None.

## X. RELATED PROCEEDINGS - APPENDIX

None.